

Three Technologies That Will Change Commercial Space

Tom Cwik

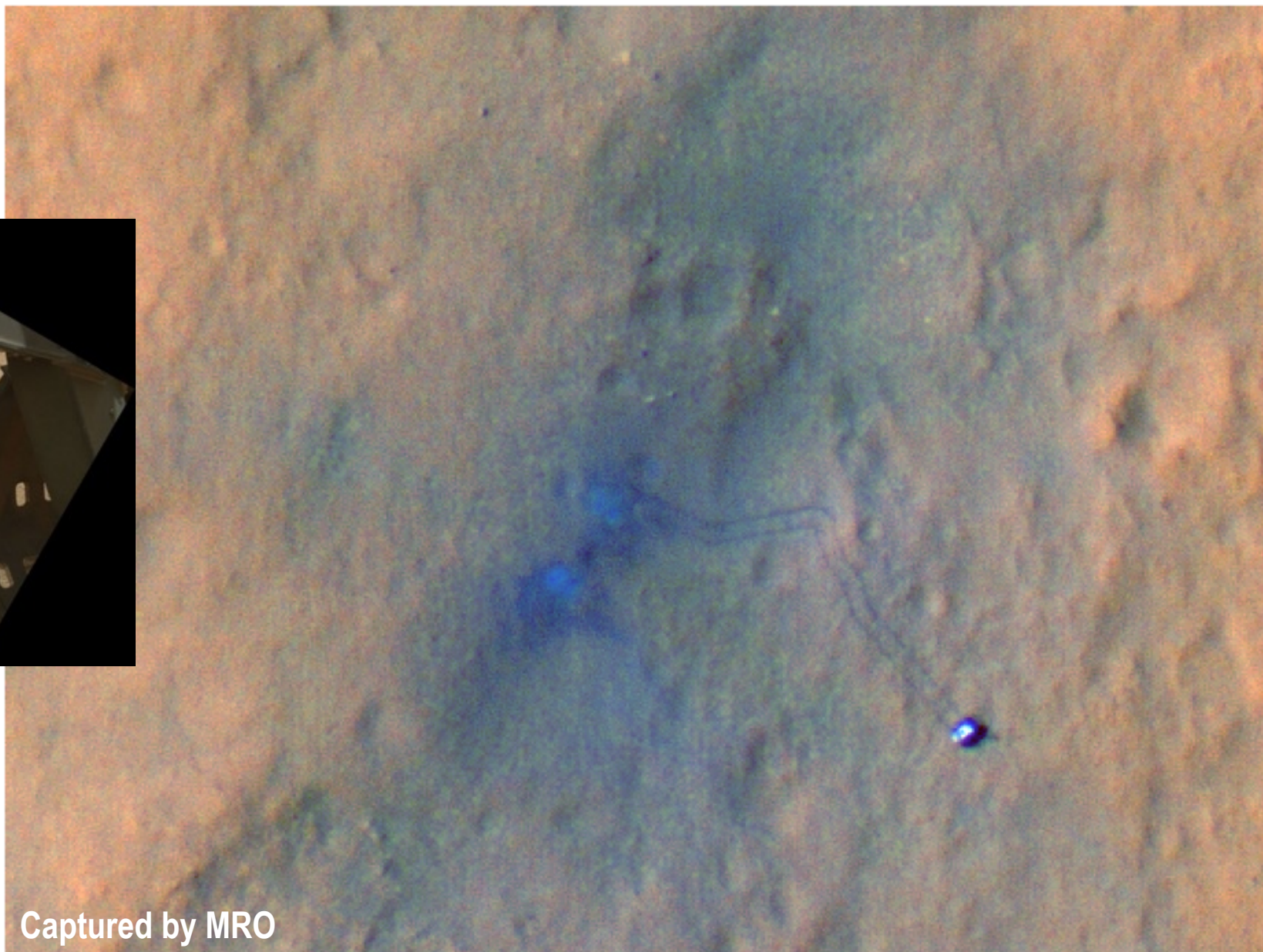
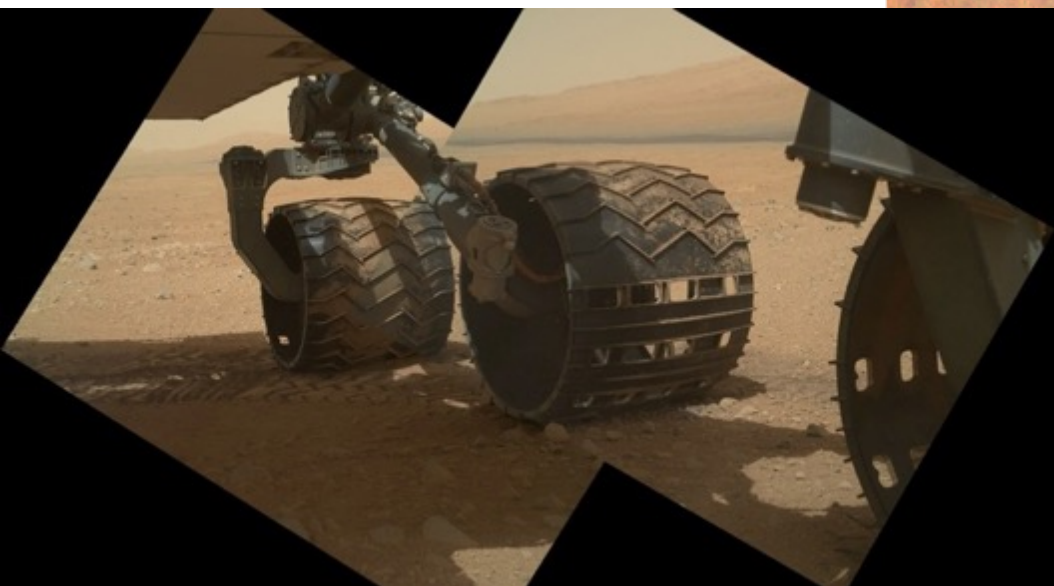
*Jet Propulsion Laboratory
California Institute of Technology*

January 12, 2018

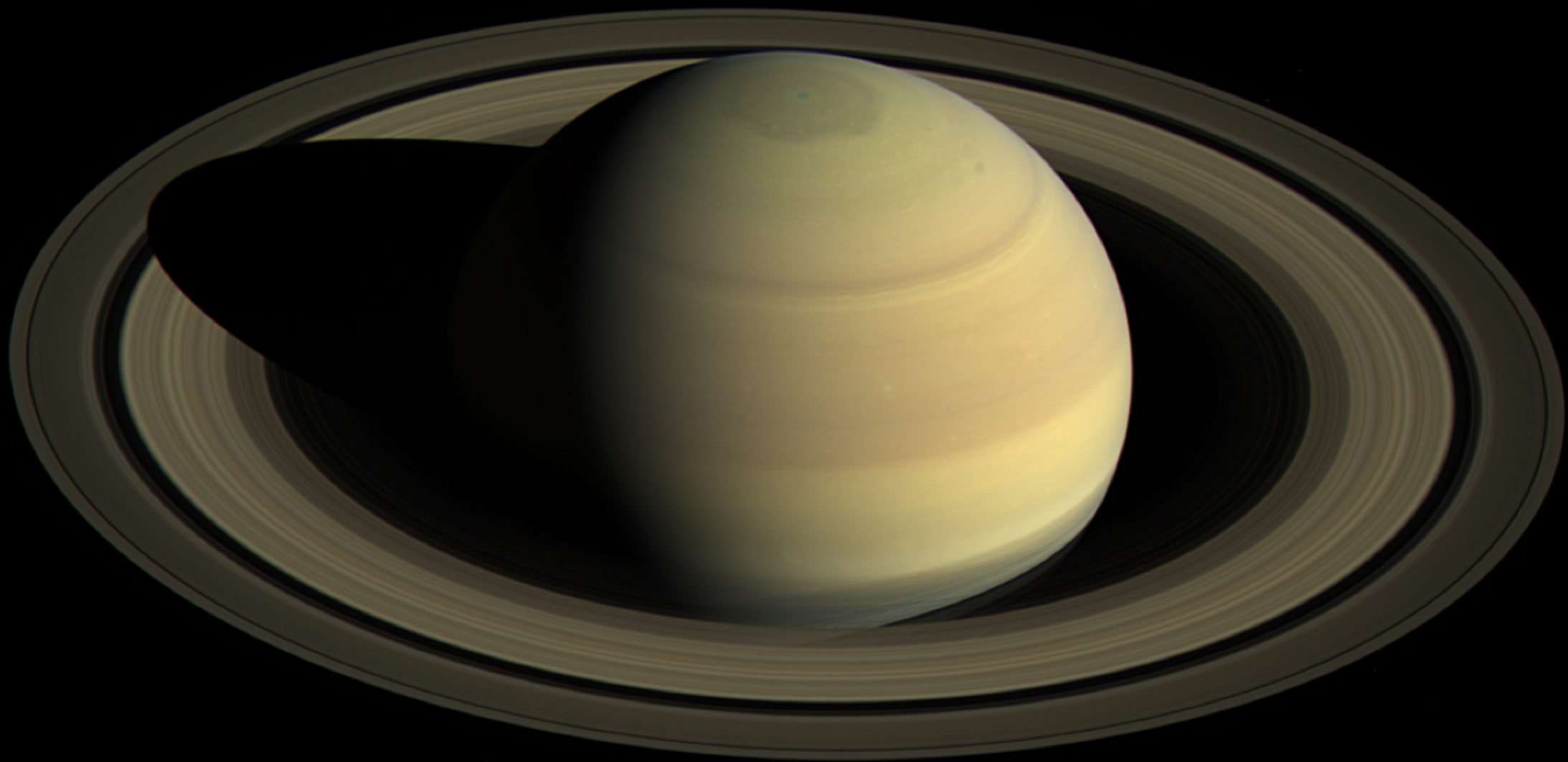
*2018 Defense Outlook & Commercial Aerospace Forum
New York, New York*

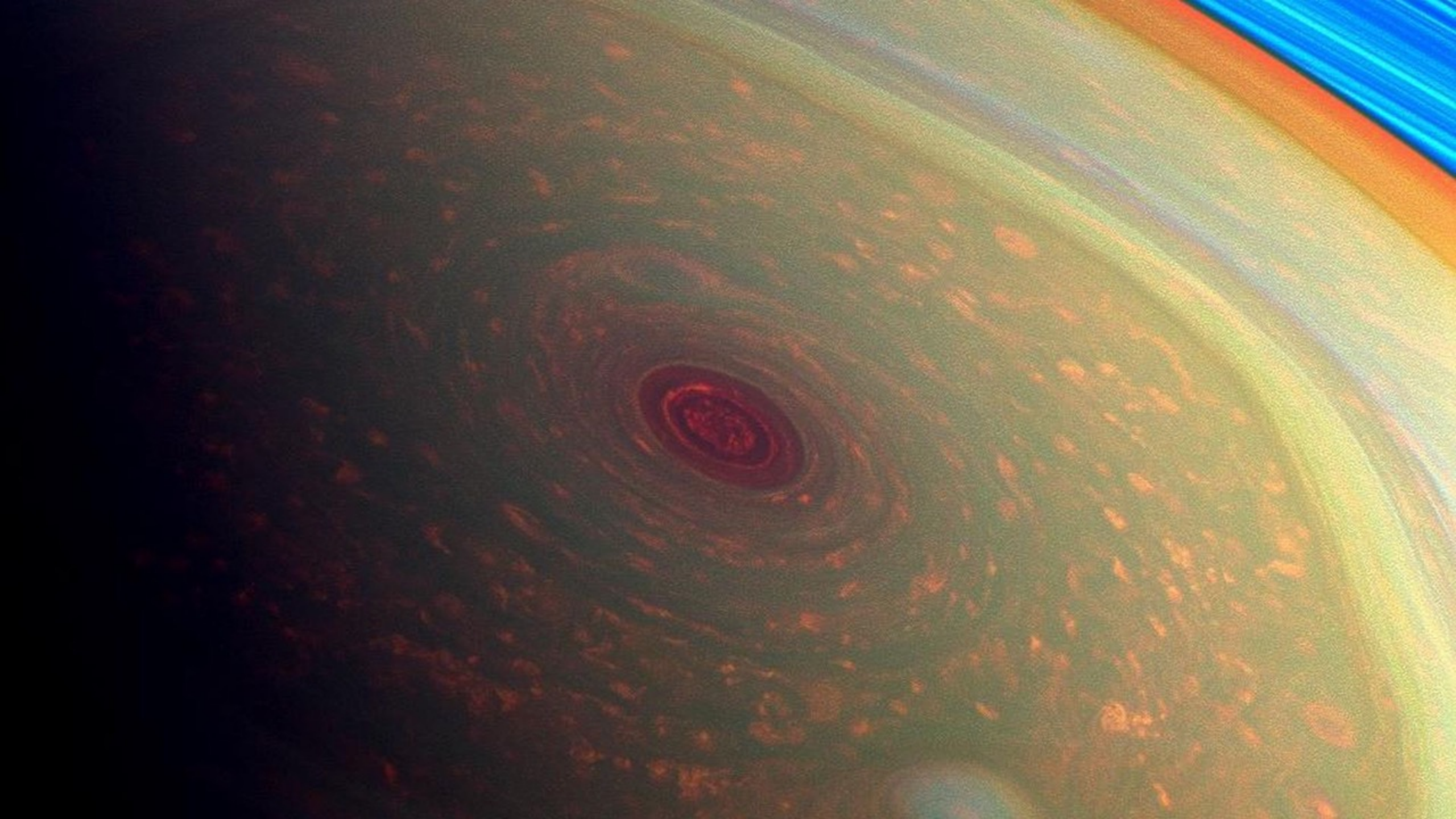


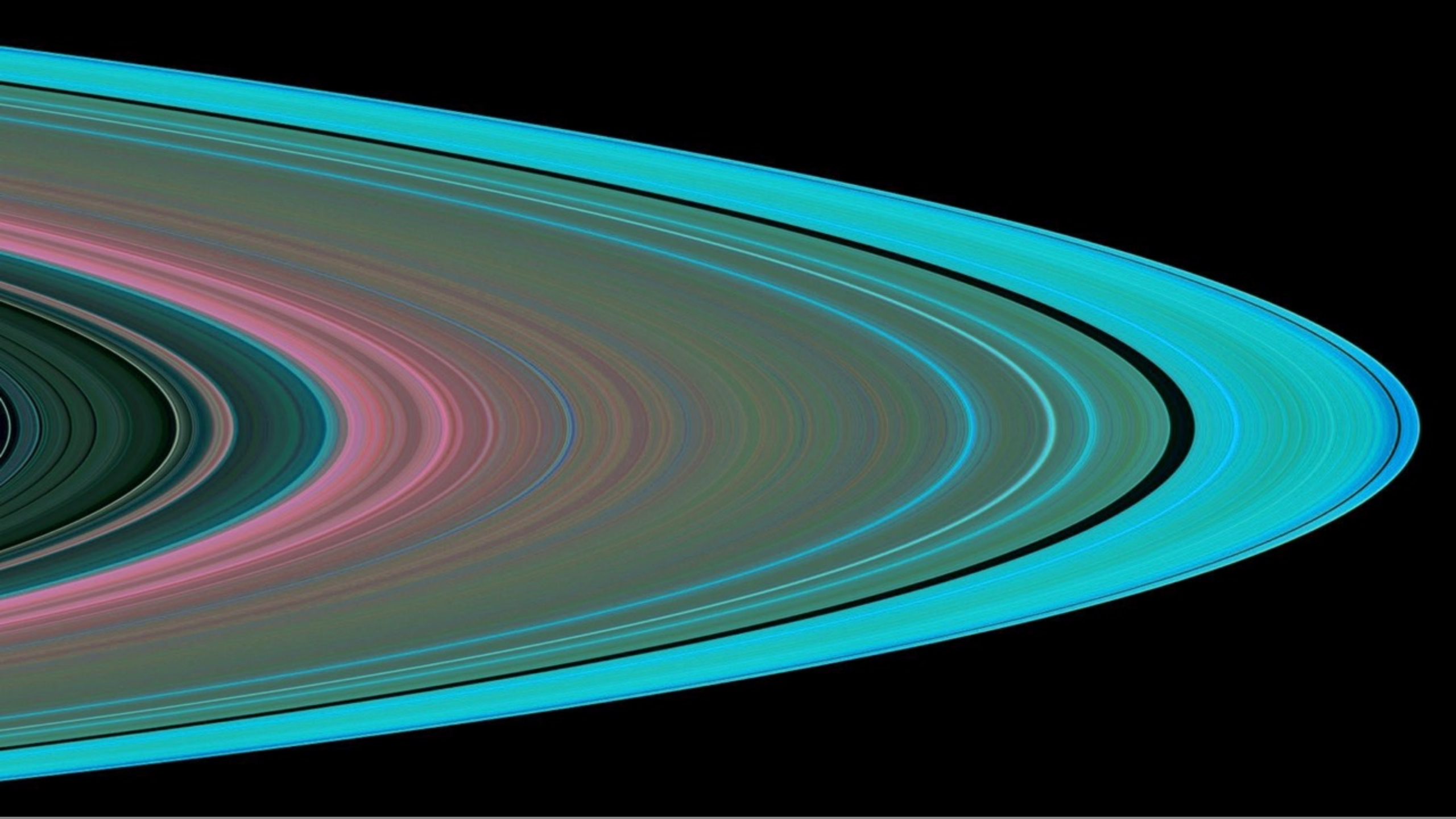
This boulder is the size of Curiosity

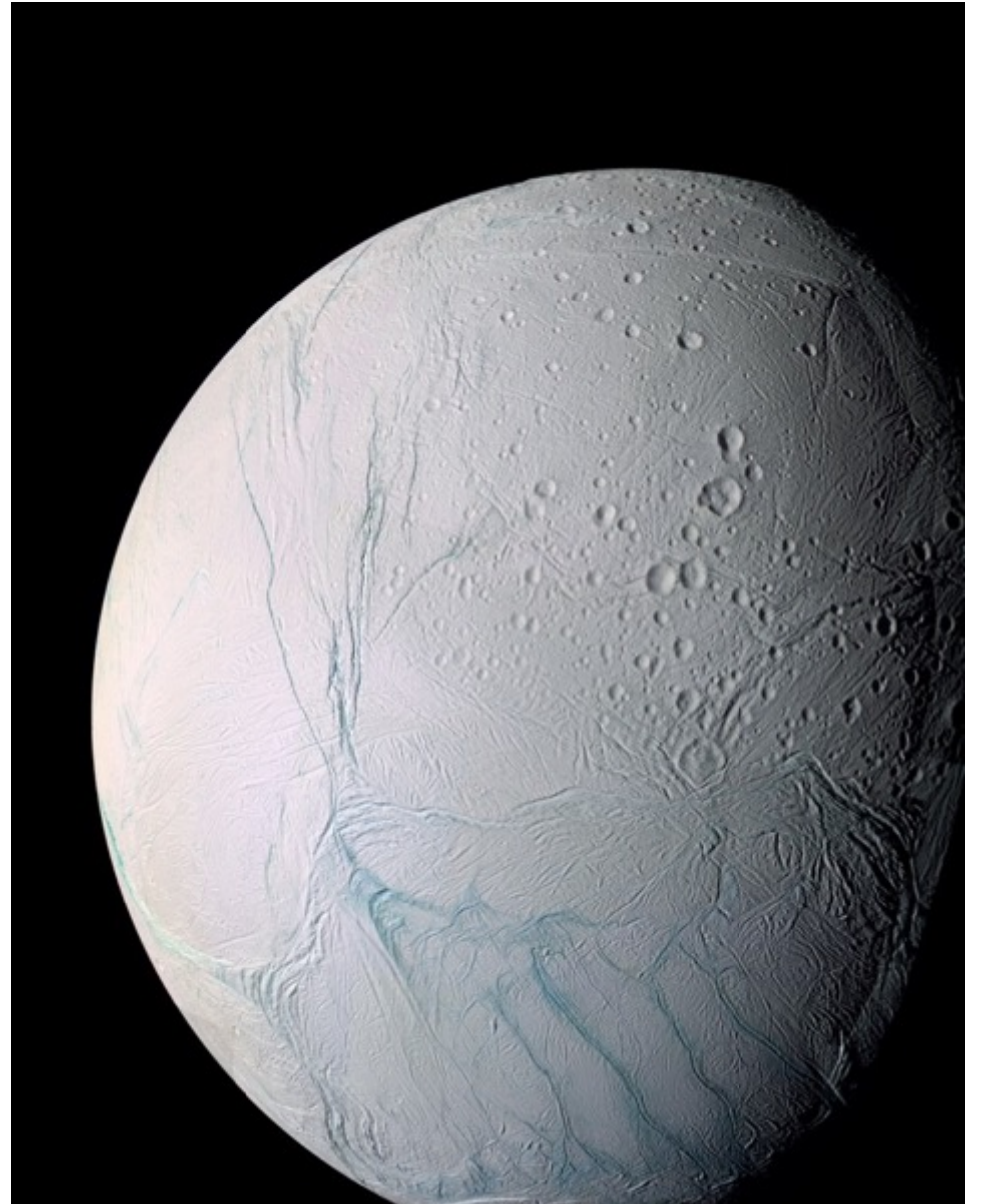
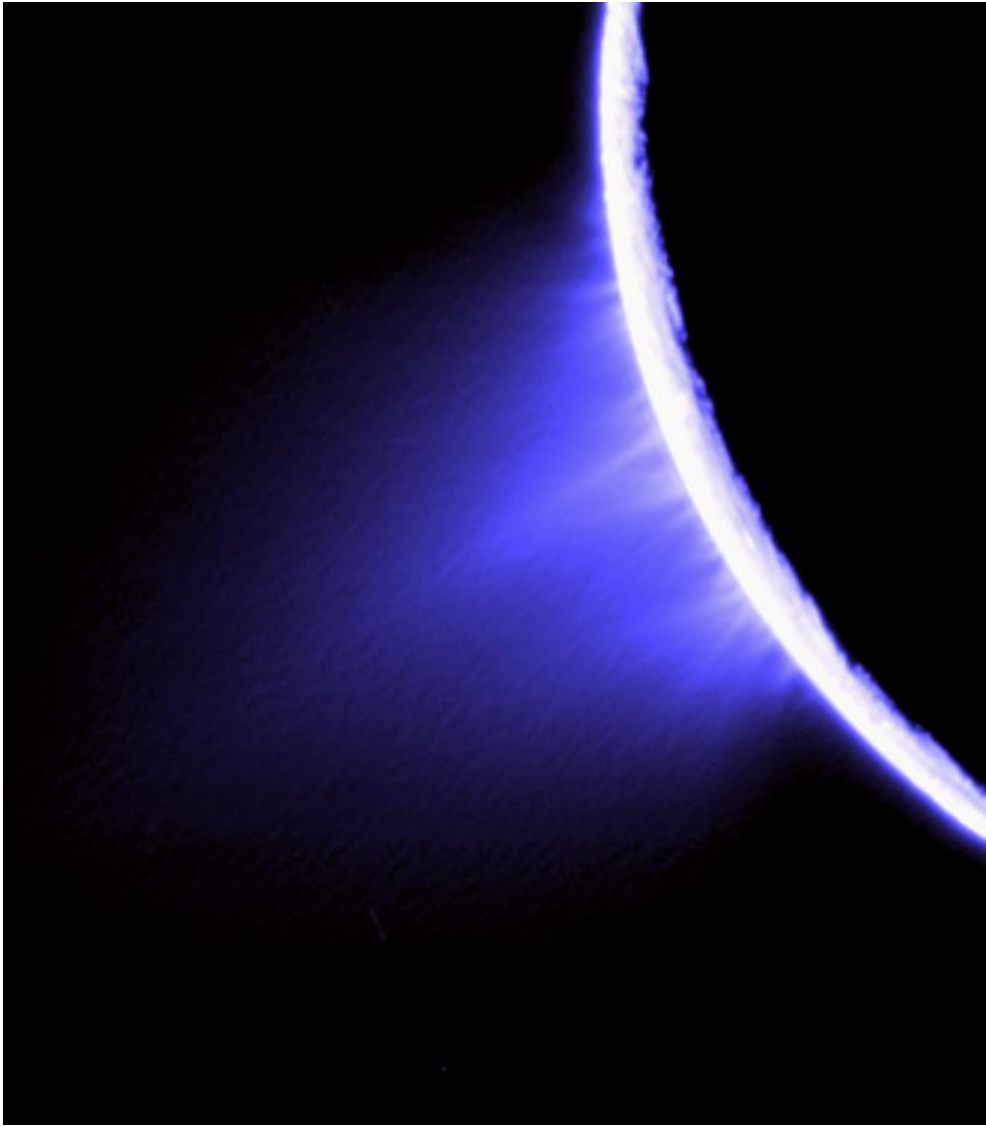


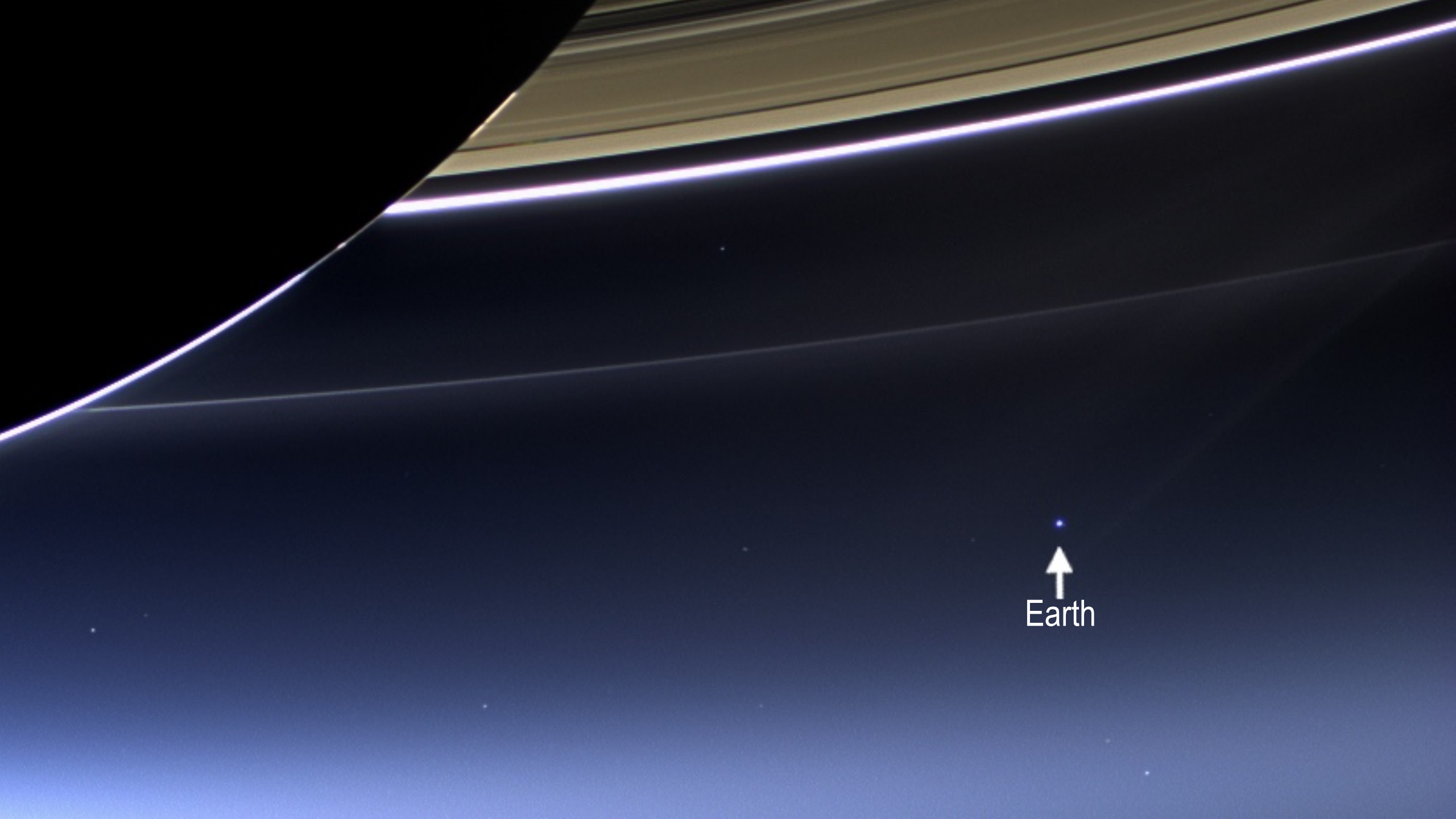
Captured by MRO











↑
Earth



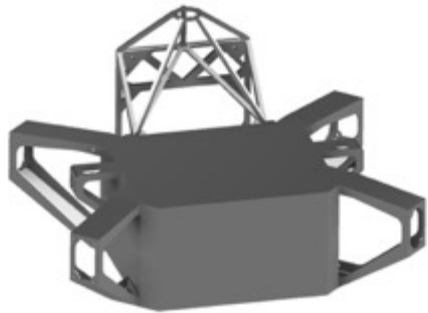
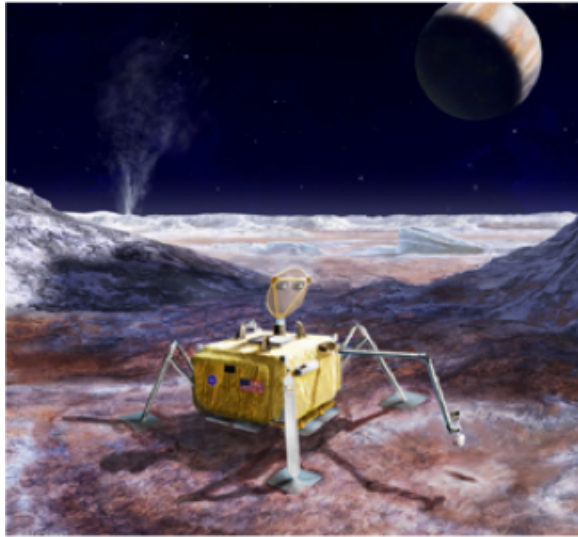
Digital Fabrication

Autonomous Operations

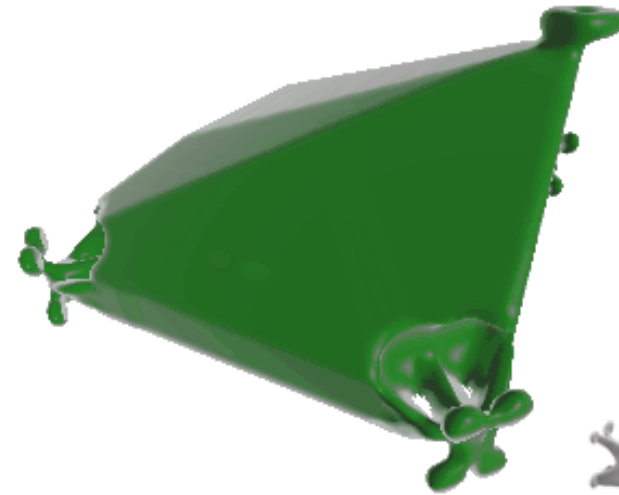
Spacecraft and Space Data AI

Digital Fabrication

Generative Software Design + Advanced Manufacturing



Baseline = 61kg



Solution = 47kg



Digital Fabrication

- *Design-by-software* tools and companies are in upheaval
- Advanced manufacturing (like 3D printing) is becoming established

These two forces are becoming integrated and
revamping how we design and build → “*Digital Fabrication*”

For Commercial Space, *Digital Fabrication* will:

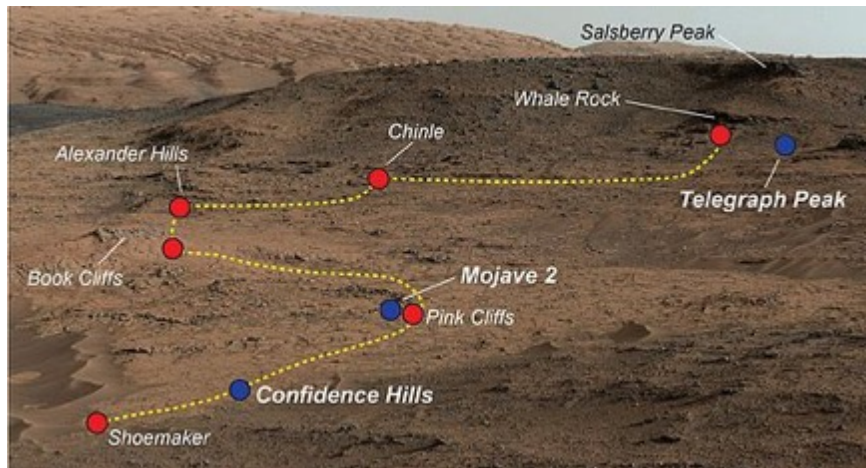
- Drive an increase in performance of existing systems
- Provide design time to create new function and performance
- Enable competition among developers and spur new companies



Autonomous Operations



Where autonomous cars are going,



... space will follow



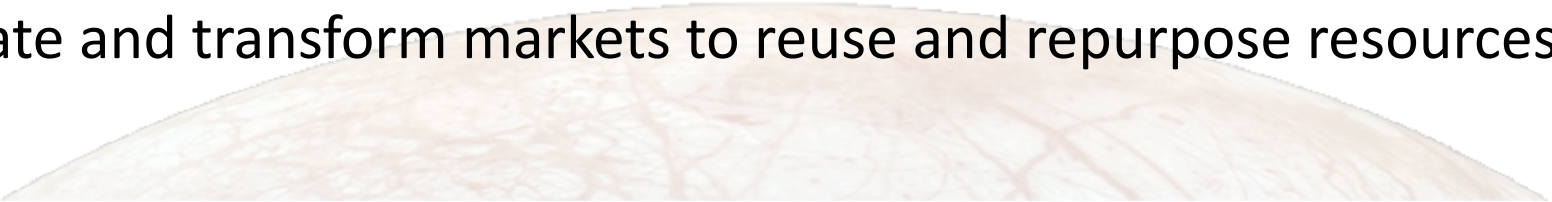
Autonomous Operations

Integration of

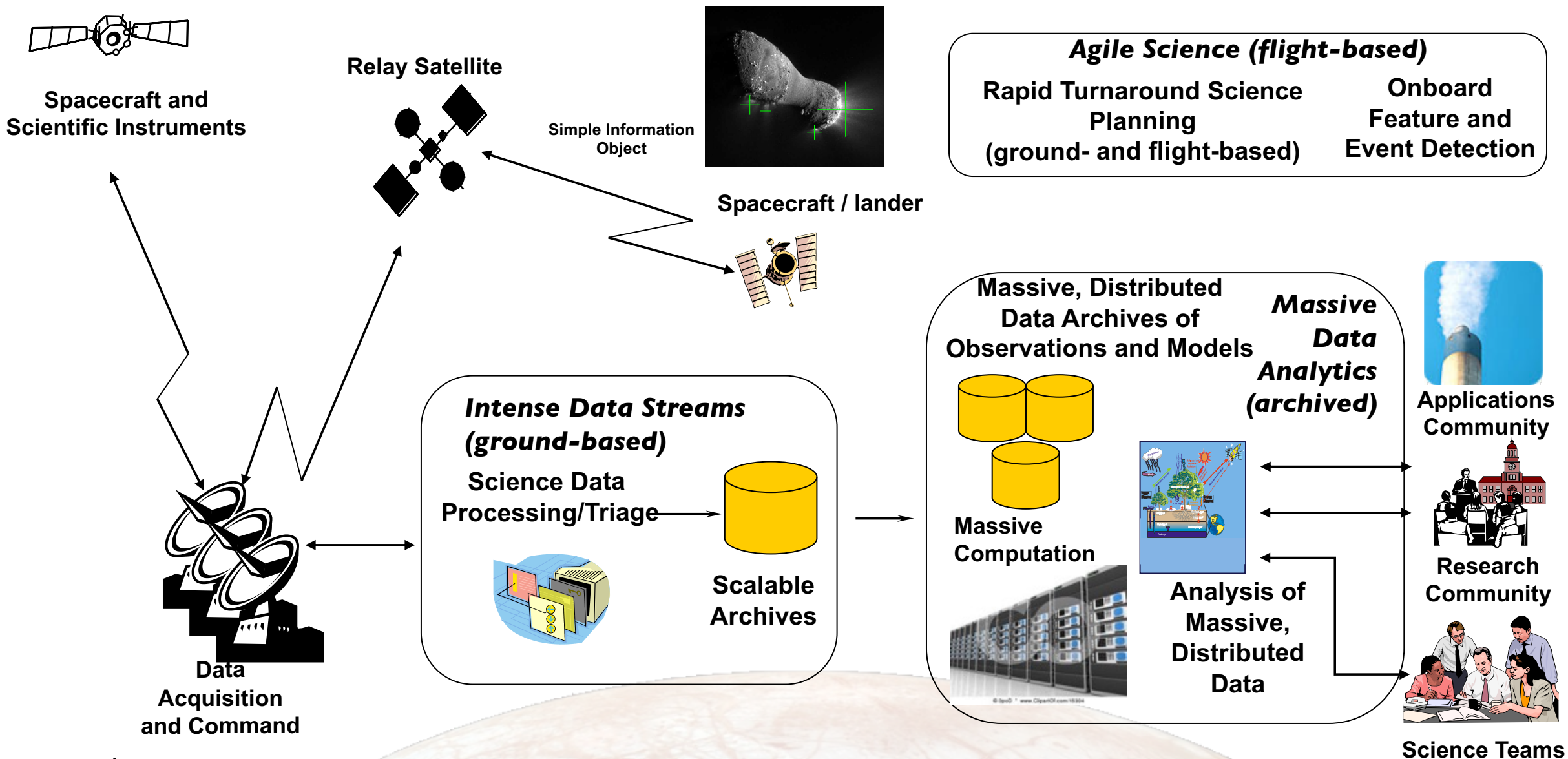
- a number of sensor systems with perception and object recognition
- decision software architecture
- hardware (car, drone) and human operator

.... is transforming transportation

For Commercial Space, *Autonomous Operations* will

- Allow fleets of Earth observing spacecraft to be operated autonomously
 - Enable coordination of commercial telecom and remote sensing systems
 - Instigate and transform markets to reuse and repurpose resources
- 

Spacecraft and Space Data AI



Spacecraft and Space Data AI

The science of

- accumulating large, curated, focused data sets and systems
 - machine learning algorithms with a (semi)-mathematical basis
 - processing hardware that is matched to the algorithms
- is creating a broad economic force in multiple industries

For Commercial Space, *Spacecraft and Space Data AI* will

- producing actionable insights from Earth observation data at global scales and with low latency
- create demand and markets for Earth observations in new and diverse fields
- allow spacecraft to self diagnose, self operate both individually and in large coordination



